

VALUE ENGINEERING WORK PLAN

REMEDIAL ACTION DESIGN FOR BRIDGEPORT RENTAL AND OIL SERVICES (BROS) BRIDGEPORT, NEW JERSEY

**U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY DISTRICT, MISSOURI**

MAY 1985

TAMS TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS, ARCHITECTS AND PLANNERS

 **ecology and environment, inc.**
International Specialists in the Environmental Sciences

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VALUE ENGINEERING

GENERAL

Value Engineering (VE) is a disciplined effort to analyze the functional requirements of a project for the purpose of achieving its essential functions at lowest total cost (capital, staffing, operating, maintenance) over project life. Value Engineering is a systematic, organized approach to obtain optimum value for each dollar spent. Through a system of investigation, using multi-disciplined teams, value and economy are improved by eliminating or modifying items not essential to accomplish the required performance. Using creative techniques and state-of-the-art technical information on new materials and methods, alternative solutions are developed for specific functions.

The objectives of Value Engineering studies for the BROS project, are to obtain the best design with a functional balance between construction costs, user needs and life cycle costs, resulting in a savings of proposed capital costs and a reduced operation and maintenance burden for the completed facilities.

BROS PROJECT

The project to be accomplished by the Joint Venture team of TAMS and Ecology & Environmental consists of preparing plans and specifications for remedial action measures at the Brigeport Rental and Oil Services (BROS) site located in Logan Township, Gloucester County, New Jersey. Value Engineering will be performed on those remedial measures which involve cleanup of an on-site 12.7 acre oily waste lagoon (PCB laden). Specifically, the Value Engineering effort will evaluate

remedial measures proposed for lagoon oil-water-sediment removal and treatment, drum removal, lagoon closure, and surface cleanup.

Why not TANK removal?

The Record of Decision (ROD) for the BROS project specifies that lagoon oily waste is to be disposed via on-site incineration (off-site incineration may also be permitted). Sediment from the lagoon is to be disposed in the same manner as oily waste. Water is to be disposed via an on-site treatment system. Given the ROD's guidance, the Value Engineering program will be confined to consideration of those disposal options which conform to its specifications.

The value engineering work to be performed for BROS will consist of the following tasks:

- I Pre-Study Effort
- II Value Engineering Study (Completion of Preliminary Design)
- III Post-Study Effort - VE Proposal Report

Value Engineering work is expected to commence as soon as preliminary disposal concepts have been established but before they are presented to the Corps. Thus the program will be initiated about the time Subtask 5.j (see "Scope of Work" submitted 4/25/85) is being completed.

Why
so soon?
should be
CDE
get
1st

The Value Engineering services will be performed in accordance with latest Corps of Engineers Guidelines as given in VE Workbook and Proposal Summary Report, forms 3986-R and 3987-R, respectively, and accepted SAVE recommended guidelines. It is anticipated that the VE work will be carried out by team comprised of staff members from the joint venture of TAMS and

E&E, and Cross Tessitore, a subcontractor. To facilitate the work, the team's studies will be conducted at TAMS' New York office.

It is expected that the VE job plan be conducted in consecutive days to completion. The job plan will include the following phases:

- Information
- Speculation
- Analyses
- Development
- Recommendation/Presentation

These activities are described in more detail below and tabulated by objectives, questions and techniques at the end of this report (see Phases of the Value Engineering Job Plan).

THE VALUE ENGINEERING JOB PLAN

The Value Engineering study will include three tasks or phases of work: the pre-study effort; the study; and the post-study effort. Activities to be carried out by the VE team during each of these phases are described below.

Task I Pre-Study Effort

The major element of Pre-Study work will be its informational phase and will include, in part, the following activities:

- Conducting an orientation meeting prior to the VE workshop with the Design Team and Project Management to review activities, schedule and responsibilities
- Identifying constraints to the study

- Making a site visit to better understand project conditions
- Finalizing arrangements for VE workshop
- Convening the workshop
- Reviewing project documents and distribute information to the VE team members
- Developing Functional Analysis System Technique (FAST) diagrams
- Determining Cost - Function relationships

Success of the VE Pre-Study phase will largely depend on proper preparation and coordination. Information and documents will be furnished by the Design team and distributed to the VE team to prepare them for their study.

The VE team must depend on the Design team for the completeness and organization of the material furnished. Availability of complete data will prevent the VE team from generating comparisons already made by the Design team. The Design team will be instructed to use their best judgement in organizing the material.

The following listing indicates the type of data, in addition to the preliminary conceptual plans, that are required for an effective Value Engineering study.

- *ROD*
- Corps Design Standards
- Program Requirements
- Design Criteria
- Design Calculations
- Alternate Designs Considered
- Pertinent Regulations & Codes

- Appropriate Project Correspondence
- Estimate of Construction Cost
- Estimate of Operating Cost
- Other Studies and Reports

Task II Study

The Study phase of work will be comprised of speculative, analytical and developmental elements. During speculative work, the VE team will use the following techniques to develop ideas that accomplish basic functions of the project:

- Blast, create, refine
- Oversimplify
- Free wheel
- Refrain from making judgments
- Build on ideas
- Modify and combine ideas

Since a Record of Decision has been prepared for this project, it will be considered during this task as the basic framework within which the VE Study will be performed. No other constraint on the flow of ideas is expected during this phase of work.

The analytical work will consist of ranking, evaluating and selecting ideas which are considered most feasible. In order to accomplish the alternative selections, some techniques to be used will be:

- Ranking by use of weighting criteria matrices
- Inquiry of agencies, researchers, suppliers and contractors with state-of-the-art knowledge in incineration, lagoon cleanout, and waste treatment methods

- o Production of sketches of possible alternative solutions

Development work will consist of refining and developing specific changes to the Design team's concept. At this stage it will be necessary to obtain specific technical and cost information for proposed selected alternatives. Specific information will have to be gathered to insure that the alternative schemes meet all project requirements, are capable of being implemented, and whether they generate secondary benefits.

Secondary benefit of original Design team recommendation taken into account?
Task III Post-Study Effort

The Post-Study effort will consist of the presentation phase. The selected alternatives will be proposed in oral and written presentations.

Oral presentations will be given at a scheduled meeting at the end of the project's preliminary engineering Subtask (Subtask 5.q of "Scope of Work"). It is anticipated that the Value Engineer will make the presentation. He will utilize visual aids and graphical data to "sell" the VE team's alternative solution(s).

The written presentation will consist of completed copies of the Corps' VE Workbook and Proposal Summary Report. It is expected that the written presentation will be submitted no later than two weeks after the meeting.

VALUE ENGINEERING TEAM

Members of the VE team will be selected from engineering and other technical disciplines which are relevant to the project. Potential team members will all have extensive

Questions

What it it? ^s — ?
What must it do?
What does it cost?
What is it worth?

Techniques

Functional analysis (FAST diagram).
Cost - Worth Concept.
Graphics.

SPECULATION

Objective

Generate alternatives for meeting requirements.

Questions

What else will perform the required function?

Technique

Creative thinking processes (e.g., brainstorming).
Deferred judgment.

ANALYSES

Objective

Evaluation and selection of best cost saving alternatives.

Questions

What will the alternatives cost?
Will the alternatives meet the required functions?
What proposals have greatest cost savings?

Technique

Life cycle costing.
Weighted constraints evaluation.
Idea ratings.

DEVELOPMENT

Objective

Presentation of best cost saving alternatives.

Questions

How best to present proposals?

Techniques

Narrative reports.

Schematic overlays.

Graphics.

PRESENTATION

Objective

Define and quantify results.

Question

What was implemented?

Techniques

Visual aids and graphics.

ANY
~~DESIGN TEAM~~
~~CROSS-OWNERSHIP~~

APPENDIX TO
VALUE ENGINEERING PLAN
TEAM RESUMES

Education

Brooklyn College, B.A., Geology, 1952
City College of New York, B.C.E., 1964
Special Course: Seismic Design Earth and Rockfill Dams, University of Missouri, Rolla

Publications

Co-author, "Consolidation Testing with Back Pressure,"
Journal, Soils and Foundation Division, ASCE, Sept. 1964

Professional Registration

P.E., New York

Technical Societies

Member, American Society of Civil Engineers

Professional History

1955 - date

Associate, Principal Geotechnical Engineer and Soil Mechanics Laboratory Director — Tippetts-Abbett-McCarthy-Stratton, New York. Project Manager for Geotechnical Engineering "As Needed" Contract, PANY&NJ; Safety Evaluation of Waterbury Dam, Vermont; Dynamic Stability Analysis of Knightville Dam, Mass.; Geotechnical Appendices to reports on Additional Locks Study, St. Lawrence Seaway; Sandusky Dike Project, an on-shore dredged spoil disposal site; safety inspection and evaluation of non-Federal dams in Massachusetts 1976 - date.

Principal Geotechnical Engineer for bid design of foundation for 3-concrete gravity structures, a concrete double arch dam, and a 270 ft. high concrete faced rock-fill dam, California; investigation and redesign of five miles of highway, Virginia; design of excavated head and tailrace channels, earth embankment and foundation for 200 MW powerplant, Texas; Instructor of techniques and procedures for static and dynamic triaxial testing, Guyana, 1976 - date.

Senior Geotechnical Engineer for design of 60 m high and 11 km long earthfill dam, Casa de Piedra, Argentina; design of 215-foot high earth and rockfill dam, Pond Hill, Pa.; redesign of hydraulically inadequate spillways on four Federal dams, Ohio, participated in the design of other earth, earth and rockfill dams, highways, subways, embankments, pumped storage facilities, airports, flood protection and waterfront facilities. Performed two-and-three-dimensional stability analysis, settlement analysis, sedimentation studies, and prepared foundation design reports for various projects. Programmed design procedures and soil test data for computer analysis, including finite element. Planning, supervision and evaluation of field exploration and laboratory testing programs. Designed field sampling and laboratory soil testing equipment and developed operational procedures. Advisor for equipment design and testing procedures for 24-inch diameter triaxial compression apparatus, Tarbela Dam Project, Pakistan. Assisted in development and supervised cyclically loaded triaxial tests for reevaluation of Sawpit Dam, California. In charge of planning and purchasing of laboratory and field testing equipment for major project laboratories overseas. Advised on subsurface exploration for Baltimore Subway. Designed foundations for cut and cover sections and station for Atlanta Subway. 1960 - 1976.

1952 - 1954

Military service — United States Army.

1952

Cartographic Aide — United States Navy, Photogrammetric Division, Hydrographic office, Suitland, Maryland. Compilation of data from aerial mapping for preparation of hydrographic charts.

EDUCATION:

B.S., Chemical Engineering, Grove City College

EXPERIENCE:

Mr. Say has 22 years' experience as a chemical, pilot-plant, and process engineer. His recent projects include participation in the development of process flow modifications for a waste facility in Illinois containing creosote and pentachlorophenol; and assistance in the development, construction, and implementation of remedial alternatives at the Hyde Park federal Superfund site in Niagara Falls, New York.

For 15 years, Mr. Say was principal process engineer for a chemical manufacturing corporation, responsible for heat and material balances, equipment sizing and selection, development of processes and flow sheets, and plant design/debottlenecking. He was process engineer for the \$2.3-million expansion of a hydrogen/carbon monoxide plant in LaPorte, Texas, and performed process calculations, plant design, equipment specification, start-ups, computer monitoring and control, efficiency studies, and performance testing for coal gasification processes; ammonia, methanol, and hydrogen plants; liquefied natural gas baseload; and hydrogen recovery. As a process development engineer, Mr. Say also designed and evaluated the economics of scale-up for electrolytic cells used in the production of fluorochemicals. For an agricultural chemicals development program, he was responsible for pilot-plant production, testing, and corrosion studies on defoliants.

While employed for four years in the development laboratory of an atomic energy corporation metallurgy department, Mr. Say conducted research and development (R&D) on gaseous diffusion technology, mainly dealing with the improvement of cascade conditions for the separation of uranium isotopes. His responsibility for all project phases, from scale-up of pilot-plant processes to the full-size plant, included equipment design, fabrication, operation in steam-cleaning tests, and scale-up from pilot-plant to full size operation.

Mr. Say also has conducted R&D for high-temperature gas/solid reactions of fluorine with nickel, monel, stainless steel, and other metals; for fluoride film protective coating; and for determination of uranium hexafluoride consumption properties of

various potential cascade materials such as nickel-aluminum alloys. He has conducted corrosion studies and, as a result of his high-temperature reaction work, is experienced in reactor construction, temperature control, and the establishment of treatment conditions.

SPECIAL EXPERIENCE:

Laboratory

Mr. Say's laboratory experience includes quality control analysis, determination of plant equipment efficiency, sample preparation, and the routine analysis of product quality.

As an engineer trainee, he aided in the pilot-plant testing of a York-Scheibel extraction column that resulted in the solution of a contaminated emulsion carryover problem in a plant extractor.

Additional Training

Mr. Say has completed additional coursework in engineering and business communication at Ohio University. He also has completed courses in chemical engineering, catalyst selection and evaluation, applied combustion, and heat exchangers for the process industries at the Center for Professional Advancement in New Brunswick, New Jersey.

EMPLOYMENT:

Ecology and Environment, Inc., Buffalo, New York, 1985-present
Self-Employed, Wescosville, Pennsylvania, 1984

Air Products and Chemicals, Inc., Allentown, Pennsylvania,
Principal Process Engineer, 1968-1983

Goodyear Atomic Corporation, Piketon, Ohio, Technical Engineer,
1964-1968

Koppers Company, Inc., Petrolia, Pennsylvania, Laboratory
Technician/Engineer Trainee, 1963

PROFESSIONAL AFFILIATIONS: NONE

David L. Say (Cont.)

ED. DATES: BS 1964
Oh Univ. eng. 1964, bus. comm. 1965
Ctr. for Prof. Advance: chem. eng. 1979; catalyst
1980; combustion & heat exch. 1981

BIBLIOGRAPHY:

Say, D.L., Patent No. 3,779,725, "Coal Gasification."

LANGUAGE CAPABILITITES: FRENCH

EDUCATION:

Master of Engineering Degree, University of Florida,
Gainesville, in Air Pollution Control

B.S.C.E., University of Florida, Gainesville

B.S.Ch.E., Northeastern University, Boston, Massachusetts

MEMBERSHIPS

Diplomate in Air Pollution Control

American Academy of Environmental Engineers (AAEE)

Registered Professional Engineer in ten Eastern States

Member of Air Pollution Control Association (APCA)

EMPLOYMENT HISTORY

President, Cross/Tessitore & Associates, P.A., environmental
engineering firm specializing in air pollution control
(Orlando, Florida), 1976 to present.

Principal Consultant, Air Pollution Control, Roy F. Weston,
Inc. (West Chester, Pennsylvania), five years.

Deputy Director, Air Pollution Control Training Program, U.S.
Environmental Protection Agency (Research Triangle Park, North
Carolina), two years.

PROJECT EXPERIENCE

Incinerator Design

- Griffith Laboratory (sludge burning unit)
- Pittsburgh Glass (gaseous waste unit)
- Yorke Doliner & Company (solid waste/wire)
- National Institutes of Health (conceptual)
- Steele Industries (existing incinerator conversion)
- Department of Energy (fluidized bed)

Incinerator Testing

- General Electric, Massachusetts
- Railroad, Corinth, Mississippi
- Humko, Auburndale, Florida
- Colt Industries, New Jersey

RELATED TECHNICAL PUBLICATIONS

National Incinerator Conference - Metal and Particulate Emissions from Incinerator Burning Sewage Sludge and Mixed Refuse.

National Incinerator Conference - Effluent Water from Incinerator Flue-Gas Scrubbers.

RELATED BOOKS AND PUBLISHERS

Preparation of Specifications for Air Pollution Control Equipment; Marcel Dekker.

Operating & Maintenance for Air Pollution Control Equipment; Technomic Publishing, Ann Arbor Science.

Air Pollution Control; Technical Publishing.

RELATED TRAINING COURSES

Operation & Maintenance of Air Pollution Control Equipment; APCA, ASME, GWU (Air Pollution Control Association, American Society of Mechanical Engineers, The George Washington University).

How to Prepare Specifications for Air Pollution Control Equipment; Pennsylvania State, APCA, ASME, GWU (Air Pollution Control Association, American Society of Mechanical Engineers, The George Washington University).

How to Design Industrial Incinerators; University of Wisconsin.

RELATED STACK SAMPLING EXPERIENCE:

Editor, STACK SAMPLING NEWS, seven years.

Founder, SOURCE EVALUATION SOCIETY.

Education

University of Yassy, Rumania, B.C.E., 1939

Technical Societies

Member, American Society of Civil Engineers
 Member, American Association of Cost Engineers

Professional History**1975 - date**

Principal Cost Engineer — Tippetts-Abbett-McCarthy-Stratton. Cost estimating and scheduling for: sections of Atlanta, Baltimore, Washington, D.C. and New York subway tunnels and stations; Pond Hill Water Reservoir and Dam, New Jersey; Bloomington Recreation Lake and Dam, New York; Merrill Creek Reservoir, New York; Ashokan Dam, New York; Tarbela Dam, Pakistan (claims, Engineer's Decisions and additional contracts); Port Facilities, Puerto Castilla, Honduras; Port Cristobal, Panama; Jubail harbor facilities and highways, Saudi Arabia; Jari River Basin dams and hydropower facilities, Brazil; Ahmed Hamdi Tunnel and Port Damietta, Egypt; Botzam Highway, Botswana; Hartsfield International Airport, Atlanta; Eastern Airline Terminal Renovation, JFK International Airport, New York; Pittsburg International Airport, Pennsylvania; Kimpo International Airport, Korea; Israeli Air Base (estimating and specifications); N.A.S. Hangar and Pumping Station, Brunswick, Maine; and Ouagadougou-Tambao Railroad, Upper Volta.

Structural Engineer. Construction costs for subway section of Washington, D.C. Metro. Participated in underpinning design for Laurens Street Section of Baltimore Subway and Washington, D.C. Metro Subway Section F-3. Performed studies for tunnel excavation costs on rail rapid transit projects. 1975 - 1976

1974 - 1975

Senior Engineer — Soros Associates, Inc., New York City. Participated in redesigning wharf for Trombetas, Brazil. Performed engineering studies and cost estimates for coal loading piers, Port Richmond, Philadelphia; offshore ore loading facilities in Narvik, Norway and feasibility of an offshore loading wharf in Buchanan, Nigeria.

1966 - 1974

Senior Design and Cost Engineer — Singstad, Kehart, November & Hurka, New York City. Construction cost estimating and structural design for the Baltimore Harbor Outer Tunnel, 76-inch diameter Water Transmission Main, Baltimore, Maryland; IND Subway connection to 63rd Street Tunnel, New York City; Subway Routes 133 and 131D, Queens, New York City; and Washington, D.C. Subway sections K 001 and K 002. Coordinated the checking of shop drawings for Big Walker Mountain Tunnel, Virginia and Lake Huron, Detroit, 16-foot diameter Water Supply Tunnel and Intake Shaft.

1961 - 1966

Research Engineer — Central Laboratory for Research and Quality Control of Constructions, Bucharest, Rumania. Performed research for new anticorrosive materials, field and laboratory quality control of reinforced concrete- and steel-welded structures. Developed procedures for site testing of structures by nondestructive methods.

Consultant (Part-Time) — Institute for Oilfields Design, Bucharest, Rumania. Designed anticorrosive protection of steel and reinforced concrete structures for oil and salt water tanks and pipelines.

1960 - 1961

Senior Field Engineer — Construction Enterprises & Equipment Assembly for Oil Refineries, Brazi, Rumania. Coordinated structural design and field erection of eight large water cooling towers.

1955 - 1960

General Manager — Construction Enterprises for the Region of Bucharest, Rumania. In charge of managing government-owned contracting company, employing over 3000 people for industrial buildings, highways, bridges, and Pitesti Rumanian Air Force Base.

Education	Rensselaer Polytechnic Institute, B.S. in C.E., 1973 Lehigh University, M.S. in C.E., 1975 Polytechnic Institute of New York, graduate study.
Registration	P.E. — New York, New Jersey
Technical Societies	Member, American Society of Civil Engineers Member, Chi Epsilon, Tau Beta Pi
Publications	"Anchoring at Delta Dam," Proceedings of International Symposium on Pre-stressed Rock and Soil Anchors, Post-Tensioning Institute, October 1984 Co-author, "Tests of Bolted Beam-to-Column Flange Moment Connections," Welding Research Council Bulletin 218, August 1976
Professional History 1980 - date	Associate (1983), Principal Structural Engineer — Tippetts-Abbett-McCarthy-Stratton (TAMS), Water Resources Division. Project Manager — Ten Mile Run Culvert, New Jersey; rehabilitation of 150-year old triple barrel stone arch culvert. Project Manager — Trenton Falls Powerhouse No. 1 Project, New York; study of reuse of 1901 structure as upgraded generating facility. Lake Livingston Hydroelectric Project, Texas — layout and scheduling for 50 MW project at existing dam. Lead Engineer — Design of repairs to stilling basin and sluices at Peligre Dam, Haiti. Project Manager and Lead Engineer — Rehabilitation of Delta Dam, New York State; design of post-tensioned anchors to upgrade dam stability and concrete resurfacing to replace deteriorated downstream face, including plans and specifications. Field reconnaissance and preliminary design of small hydro projects. Project Engineer — Kensico and Ashokan Hydroelectric Projects, New York State, consisting of a 4750 kW installation at Ashokan with a new penstock, powerhouse and tailrace, and a 3000 kW installation at an existing powerhouse at Kensico, with both installations utilizing the existing New York City water supply system.
1978 - 1980	Head Design Engineer — TAMS, Tarbela Dam, Pakistan. Supervised preparation of construction drawings for remedial measures at Service and Auxiliary Spillways consisting of lining and plunge pools with concrete walls covering post-tensioned anchors of thick rollcrete walls. Prepared layout drawings for and reported on results of hydraulic movable bed model studies for spillways. Supervised preparation of as-built drawings for various project features.
1975 - 1978	Structural Engineer — TAMS, Water Resources Division. Analysis and design of general and hydraulic structures, including: dynamic earthquake analysis of existing structures, and stability analysis of mass concrete retaining structures, Tarbela Dam, Pakistan; preliminary design of inlet-outlet control structures for proposed pumped storage facilities in Delaware River Basin, Pennsylvania; design of prestressed concrete girder-composite slab bridge, Bloomington Lake Project, Maryland. Member of Concrete Dams team for Bureau of Reclamation Technology Assessment and Safety Evaluation Project. Participated in dam inspections under National Dam Safety Inspection Program. Experienced in static and dynamic finite element analysis.

Education

University of Miami, Florida, B.S., Mechanical Engineering, 1972
 Clemson University, South Carolina, M.E., Water Resources Engineering, 1975

Technical Societies

Associate Member, American Society of Civil Engineers

Professional History

1980 - date

Senior Mechanical Engineer — Tippetts-Abbett-McCarthy-Stratton (TAMS), Water Resources Division. As member of TAMS' Small Hydro Study Group, responsibilities include the conceptual development, preliminary and final design, specification and evaluation of hydraulic turbines, other hydroelectric components and related mechanical and electrical support systems for small and moderate sized projects. Project work includes site inspections, hydrologic and hydraulic studies, equipment selection of standardized versus custom Reaction and Impulse turbines, the development of power optimization computer programs to assist in and verify turbine selection and proposed operation mode, powerhouse and equipment layouts, cost estimates and economic analyses. Prepared pre-feasibility and feasibility studies, design studies and/or FERC license applications for various new and upgraded projects including: Lock E-17, NY-9.2 MW, Delta Dam, NY-2.2 MW, Pawtucket No. 2, RI-1.9 MW, Dams No 3 & 4, MV, for 7.3 and 1.4 MW respectively, Curtis-Palmer Falls, NY-60 MW, Vischer Ferry and Crescent Dams, NY-6.4 MW each, Livingston Dam, TX-50 MW. Performed similar studies for hydroelectric projects in Brazil, Ecuador and Haiti. Responsible for final design of mechanical systems including ventilation, piping, instrumentation, drainage, etc. for the Garvins Falls, NH-6.6 MW and Ashokan, NY-4.9 MW hydroelectric powerplants and the 9000 hp Pond Hill, PA water pumping station.

Assisted with project coordination and design for repair of damaged stilling basin, trash racks and high pressure sluice gates for Peligre Dam, Haiti.

1977 - 1980

Mechanical Engineer — Assisted in the Non-Federal Dam Inspection Program and performed site specific inspections for dams and appurtenant structures in the Northeast and Georgia.

Performed littoral drift data search and field reconnaissance to determine sediment transport at power station on Long Island Sound and participated in oceanographic measurements study for Environmental Impact Statement of Vieques Island, Puerto Rico.

Prepared reports of final design for utility support systems and turbine efficiency test procedures for Tarbela Dam Project, Pakistan.

1973 - 1976

Mechanical Engineer — Daniel Construction Company, Greenville, South Carolina. Responsible for on-site technical construction activities of the Rubber Mixing Plan for Michelin Tire Corporation, Sandy Springs, South Carolina. Liaison Engineer between client, general contractor, sub-contractors and field personnel. Accountable for design review; material and manpower estimates; construction schedules; the approval, procurement and expediting of material and equipment; and the preparation of subcontracts, including monitoring field work and final accounting negotiations. Inspected and approved mechanical-related site construction activities and progress. Principal Area Engineer for plant waste treatment and utility system, coordinating construction, start-up, testing and troubleshooting activities while initiating required field design modifications. Engineer responsible for project completion and engineering, purchasing and accounting close-out procedures.

1974 - 1975

Lab Assistant — Clemson University, Clemson, South Carolina. Participated in preliminary environmental assessment study of tributaries to the Savannah River to determine impact of proposed nuclear reclamation center.

1972 - 1973

Engineering Technician — United States Envelope, Mail Systems Division, Homestead, Florida. Design development and construction of rapid mail handling equipment. Lead Mechanical Designer for high-speed mail sorter project.

Education

University of Vermont, B.S., Biochemistry, 1974
Tulane University, M.S., Fisheries Biology, 1977
University of New Orleans, MBA, Management, 1981
Tulane University, Ph.D., Environmental Biology/Chemistry, 1981

Technical Societies

Member, American Association for the Advancement of Science
Member, American Chemical Society
Member, American Society of Ichthyologists and Herpetologists
Member, National Association of Environmental Professionals

Professional History

1984 - date

Hazardous Waste Management Specialists — Tippetts-Abbett-McCarthy-Stratton (TAMS). Responsibilities include field investigation management, planning and coordination of remedial investigations/feasibility studies, and development of quality assurance and safety plans.

1983 - 1984

Group Manager — NUS Corporation, Edison, New Jersey. Direction of a staff of toxicologists, chemists and public health specialists for the U.S. EPA Region II field investigation team. Group responsibilities include site safety, emergency response, sample management, data evaluation and interpretation, quality assurance and technical report writing.

Project Manager of analytical data evaluation reports for more than 20 National Priorities List superfund sites and for a complex, multi-phased dioxin (TCDD) investigation in Newark, New Jersey. Responsible for detailed project planning, public contact sampling, work plan development and field implementation at this site. Directed a random soil sampling scheme and a multivariate statistical evaluation.

Project Manager for a dioxin (TCDD) investigation in Clifton, New Jersey. Participated in numerous hazardous waste site investigations in New Jersey, New York and Puerto Rico. Sampling included air, surface water, groundwater, leachate, soil, and biological specimens.

Involved in more than 200 separate field investigations in the past eight years. Field work carried out from New Mexico to Florida, from Pennsylvania to New England and in Puerto Rico.

1982

Laboratory Director — Pan-American Laboratory, Brownsville, Texas. Instituted quality assurance and quality control procedures. Involved in sampling soil, water, fish and industrial wastes and testing for pesticides, priority pollutants, heavy metals and E P toxicity.

1975 - 1982

Aquatic Ecologist and Limnologist — Biological Consultants, New Orleans, Louisiana. Provided environmental consulting services to nine Pulp and Paper Mills across the Gulf Coast, including those of Boise Cascade, Crown Zellerbach, Georgia-Pacific, International, MacMillan Bloedel and St. Regis. Worked in planning, data collection and analysis while participating in third party environmental surveys.

1974 - 1975

Ecologist — Tippetts-Abbett-McCarthy-Stratton (TAMS).

Education	National Taiwan University, B.S., Chemical Engineering, 1957 University of Tokyo, M.S., Chemical Engineering, 1963 University of Wisconsin, Ph.D., Biochemical Engineering, 1969
Registration	P.E., New York and New Jersey
Publications	"Anaerobic Biological Treatment of Landfill Leachate," National Hazardous Waste Management Conference, 1985; "Design Considerations in Petrochemical Effluent Treatment Plant," Modern Engineering and Technology Seminar, Proceeding, 1984; "A Quantitative Approach in Design of Flocculator for Treating Raw Water," Modern Engineering and Technology Seminar, Proceeding, 1982.
Technical Societies	Member, Water Pollution Control Federation Member, American Institution of Chemical Engineers
Teaching Experience	Adjunct Professor of Chemical Process Engineering, Pratt Institute
Professional History	
1985 - date	Principal Chemical Engineer — Tippetts-Abbett-McCarthy-Stratton, New York. Provide engineering plans, engineering analyses and design for projects of water/wastewater and hazardous waste management. Responsible for formulating process alternatives for handling and treatment of hazardous wastes.
1983 - 1985	Environmental Consultant — Wehran Engineering Corporation and Soros Associates, New York. Project Manager for projects concerning landfill leachate treatment, solid waste resource recovery pilot plant engineering analysis, and environmental plans for development of an industrial port. Coordinate project schedules and designs with licensing and permit applications.
1974 - 1983	Senior Process Engineer — C-E Lummus Co., New Jersey. As a Lead Process Engineer, responsible for design of utility supply and environmental control systems. Duties involving analysis of process plant and process plant and power plant operations and recommendations for process modifications to minimize emissions or effluents. In charge of environmental laboratory. Developed processes for spent caustic recovery and chemical effluent treatment.
1972 - 1974	Senior Project Engineer — Permutit Co., New Jersey. Responsible for preparation of bidding documents and technical coordination between marketing and engineering departments. Specialized in industrial water and wastewater treatment; including design of equipment for condensate recovery, boiler feed water treatment. Engaged in market research and provided research and development recommendations to management committee.
1969 - 1972	Staff Engineer — Malcolm Pirnie, Inc., New Jersey. Responsible for process design, detail design and treatability studies of municipal and industrial water supply and waste treatment systems. Work included determination of treatment processes, specifications of equipment and preparations of reports to regulatory agencies.
1964 - 1969	Teaching and Research Assistant — University of Wisconsin
1959 - 1964	Process and Plant Engineer — Taiwan Sugar Corporation, China. Operation of sugar refinery and alcohol fermentation plant. Work included process control, product quality control and utility management.